

JOURNAL THE EAST AFRICA NATURAL HISTORY SOCIETY AND NATIONAL MUSEUM

31 July 1981

No. 171

VEGETATION ANALYSIS OF THE UPPER TELEKI VALLEY (MOUNT KENYA) AND ADJACENT AREAS.

H. Rehder +, E. Beck ++, J. O. Kokwaro +++, R. Scheibe ++

- + Institut für Botanik und Mikrobiologie, Techn. Universität München, D-8000 München 2
Arcisstrasse 21
++ Lehrstuhl Pflanzenphysiologie, Universität Bayreuth, D-8580 Bayreuth
+++ Department of Botany, University of Nairobi.

ABSTRACT

Parts of the upper afroalpine vegetation belt on the western slope of Mount Kenya were studied with respect to classification, structure and distribution of plant communities.

The upper afroalpine belt of Mt Kenya extends from about 3900 m to approximately 4600 m and is characterized by a high frequency or predominance of the Giant Groundsel (*Dendrosenecio*) *Senecio keniodendron*. Its relative, the Cabbage Groundsel *Senecio brassica* occurs in this area as well as in the lower afroalpine belt. Two main plant communities were to be distinguished within the upper belt: The 'Senecio brassica—*Lobelia keniensis* Community' (type 2) on more or less wet soils especially in the lower parts of the valleys, and the 'Dendrosenecio—Woodlands' (type 8) found on drier soils, in particular on the valley slopes. Four other plant communities were derived from these main types. The first is a variant of type 2 with *Erica arborea* and occurs in the lower parts of the area (type 3). Another variation without *Lobelia keniensis* was found on wet soil at higher altitudes (type 4). In addition small areas covered by transitional communities between types 2 and 8, either without *Lobelia* (type 5) or with those plus *Erica arborea* (type 6) were recorded.

Beside the main types and their four derivatives, 'open' or 'tussock' communities, inhabiting preferentially the upper or the flooded regions, were identified. *S. keniodendron*, *S. brassica* and the two *Lobelia*s are absent or only found as scattered individuals and often with reduced vitality. The 'Carex Bog' on wet soil (type 1) might correspond to type 2, whereas the 'Tussock Grassland' on drier soils (type 7) inclines towards type 8. This type of grassland includes the types 'Helichrysum Scrub' and 'Alchemilla Scrub' of Hedberg.

Areas with a plant cover of less than five percent are predominating on the rocky or frost affected soils above 4400 m (type 10). A special type which is somewhat intermediate between types 7, 8 and 10 is the 'Open Vegetation with *Lobelia telekii*' (type 9). This type appears generally above the area of the 'Dendrosenecio Woodlands'.

The distribution of these 10 vegetation types on the southwestern to northwestern part of Mt Kenya is shown on a vegetation map (Fig. 1).

INTRODUCTION

The afroalpine vegetation belt on the western slopes of Mount Kenya can be divided into two main zones: The lower zone extends from the upper borderline of the *Hagenia abyssinica*—*Hypericum keniense* forest at about 3200 m upwards to about 3900 m. This zone is wellknown as 'moorlands' dominated by the tussocks of *Carex monostachya*. It is also characterized by *Erica* and *Philippia* scrubs, which are well developed at elevations near the timberline but of decreasing size and covering capability at higher altitudes. From about 3500 m upwards *S. brassica* renders a special feature to the scenery.

This lower zone abruptly changes into the higher part of the alpine belt which is characterized especially by the abundance of the conspicuous *S. keniodendron*; this species appears in the lower zone only in a few poorly developed advanced posts.

The strange figures of *S. keniodendron*, reaching more than 6 m in height, are known to represent, together with its closer relatives, a peculiarity of the higher regions of mountains in tropical East Africa. They never grow at comparable sites of the temperate zones. According to the growth form system of Du Rietz (1931) they may be designated as 'Rosette-Trees'. The stands of Giant Groundsels are interspersed by *L. telekii*, a 'woolly-candle-type' rosette-plant. The other giant Lobelia, namely *L. keniensis*, however, occurs in combination with *S. brassica* in the valley bottoms and moist gullies of the side walls and also in the moorlands.

As in most mountains with a strong relief a mosaic of various plant communities and their mutual transitions is to be expected also in the upper alpine zone of Mount Kenya. Since the impact on the vegetation up to now is not very serious—except damage along the valley bottoms produced by the invasion of tourists—most plant communities can be designated as nearly or absolutely original. They probably reflect the natural differences of their sites, i.e. differences of the soil and climate conditions.

Performing ecological research on the afroalpine vegetation of Mt Kenya, an attempt was made to characterize the typical plant communities of the upper alpine zone. Ten types of such communities could be classified which were keyed as far as possible to some of the basic types described by Hedberg (1964) for the mountains of East Africa. The phenotype of each of the 10 types is clearly discernible over far distances by field-glass and thus proved suitable for mapping the vegetation over larger areas.

Because no detailed vegetation survey of the Mount Kenya National Reserve exists until now, the distribution of the new 10 types of plant communities was drawn in the 1:25 000 map of the central area. Since time was short, only an area of about 13 km² could be mapped.

CLASSIFICATION AND MAPPING

Upon visiting as much as possible of the area, repeating combinations of plant species were listed. From the records 10 vegetation types were extricated and analyzed more closely by the Braun-Blanquet-Method (see Mueller-Dombois and Ellenberg 1974). For practical reasons with respect to vegetation mapping the conspicuous species of the alpine belt which are discernible already from distance should be used as characters for identification of plant communities. Such an attempt results in a combined floristical and physiognomical classification (see Mueller-Dombois and Ellenberg 1974). This procedure proved feasible since the leaf rosette species *S. brassica*, *S. keniodendron*, *L. keniensis*, and *L. telekii*, as well as *E. arborea* obviously differ to some extent with respect to their tolerance of environmental factors. Their changing predominance, occurrence or absence as well as their mutual combinations could therefore be used as characters of some plant communities.

Useful classification of grassland vegetation is rather difficult but was facilitated by the fact that communities dominated by sedges are confined to flat and at least occasionally flooded areas accompanying the rivulets or flattenings whereas open vegetation characterized by tussocks of *Festuca pilgeri* St.-Y. ssp. *pilgeri* preferentially inhabit slopes of the valley walls.

Dwarf scrubs of the genus *Alchemilla* and *Helichrysum* and various herbaceous plants were found with the grassland and in the leaf rosette plant communities. Different contributions of such species to the plant cover results in a very complicated micropattern which proved unsuitable for mapping. Therefore no subdivision of the two types was introduced.

Since no aerial photographs of Mt Kenya National Park were available, mapping was performed by intense field inspections estimating the topographical situation of the single vegetation patches and their boundaries from different standpoints. The map of Mt Kenya 1:25 000 published by Survey of Kenya 1971 was used as a blueprint. Errors with respect to exact localization may have occurred up to about 50 m (= 2 mm on the map) especially towards the borders of the mapped area.

THE PLANT COMMUNITIES

General Description

As already stated by Hedberg (1964) and others the two *Dendrosenecios* of Mount Kenya obviously have different ecological preferences resulting in a divergent distribution. *S. brassica* being also an important member of the lower afroalpine zone (i.e. of the 'moorland' vegetation) tends to inhabit the valley bottom and the flatter inferior parts of the slopes. These generally may be the moister areas. *S. keniodendron* is dominating on the majority of the slopes, especially on boulder streams but also on fine soil material if it is sufficiently drained. These environmental conditions are treated in more detail in the following paper (Beck *et al* 1980). As a rule where it occurs *L. keniensis* is combined with *S. brassica* (*S. brassica*—*L. keniensis* Community = type 2), whereas *L. telekii* is attached to the stands of *S. keniodendron* called 'Dendrosenecio Woodlands' by Hedberg and as well in the nomenclature presented here (Dendrosenecio Woodlands = type 8).

TABLE 1

Species lists of 15 sample plots belonging to 9 of the 10 vegetation types. Cover abundance numbers after Braun-Blanquet: + = Few individuals with small cover; 1 = Numerous or scattered individuals covering up to 5% of the sample area; 2 = cover of 5-25%; 3 = cover of 25-50%; 4 = cover of 50-75% of the soil surface.

Type	1	2	3	4	6	7	8	9	10
Plot		A B C				A B C D	A B		
<i>Carex monostachya</i> A. Rich.	4					+			
<i>Agrostis sclerophylla</i> C. E. Hubb.	+								
<i>Montia fontana</i> L.	+								
<i>Romulea keniensis</i> Hedb.	+					+			
<i>Subularia monticola</i> Schweinf.	1				+				
<i>Ranunculus oreophytus</i> Del.	2				+				
<i>Haplocarpha rueppellii</i> (Sch. Bip.) Beauv.	+	1 +		2	3 +	2			
<i>Senecio brassica</i> R. E. Fries & Th. Fries		2 2 2		2	3 1	+			
<i>Lobelia keniensis</i> R. E. Fries & Th. Fries		1 1 2		2	1	+			
<i>Erica arborea</i> L.				2	2				
<i>Swertia crassiuscula</i> Gilg				1	+				
<i>Senecio keniodendron</i> R. E. Fries & Th. Fries	+		+		+	+	2 2		
<i>Lobelia teleko</i> Schweinf.					+	+	+	1	+
<i>Senecio keniiphytum</i> R. E. Fries						+	+	+	+
<i>Agrostis</i> cf. <i>trachyphylla</i> Pilg.						3			
<i>Haplosciadium abyssinicum</i> Hochst.		+				2			
<i>Dianthoseris schimperii</i> Sch. Bip.						2 +		+	
<i>Festuca pilgeri</i> St.-Y. ssp. <i>pilgeri</i>	2	2 1 2		1	2	2 4 1 1	4	+	
<i>Alchemilla johnstonii</i> Oliv.	2	3 2 1		3	2 2	2 3 1 1	1 2		
<i>Festuca abyssinica</i> Hochst. ex A. Rich.	+				+	+	1 1	+	+
<i>Anthoxanthum nivale</i> K. Schum.		+	+		+	1		+	+
<i>Helichrysum brownei</i> S. Moore		1			1		+	+	+
<i>Alchemilla argyrophylla</i> Oliv.		2			+	2	4	1	+
<i>Sagina afroalpina</i> Hedb.	+				+				
<i>Luzula abyssinica</i> Parl.		+			+	1			
<i>Pentastichis minor</i> Ballard & C. E. Hubb.			+			+	1	+	
<i>Senecio purtschelleri</i> Engl.						+	+	+	
<i>Cerastium afromontanum</i> T. C. E. Fr & Weim.						+	+	+	
<i>Arabis alpina</i> L.							+	+	+
<i>Agrostis leptophylla</i> C. E. Hubb.			+			+			
<i>Swertia volkensii</i> Gilg			+			+			
<i>Valeriana kilimandscharica</i> Engl.						+		+	
<i>Carduus chamaecephalus</i> (Vatke) Oliv & Hiern.							+	+	
<i>Carex runssoroensis</i> var. <i>aberdaricus</i> Kük.	+								
<i>Peucedanum friesiorum</i> Wolff				1					
<i>Crassula granvikii</i> Mildbr.					+				
<i>Blaeria filago</i> Alm. & Th. Fr.						1			
<i>Lycopodium saururus</i> Lam.						+			
<i>Helichrysum cymosum</i> (L.) Less.							1		
<i>Pentastichis spec.</i>							+		
cf. <i>Wahlenbergia pusilla</i> Hochst. ex A. Rich.							+		
<i>Oreophyton falcatum</i> (A. Rich.) O. E. Schulz								+	

Description of the plots:

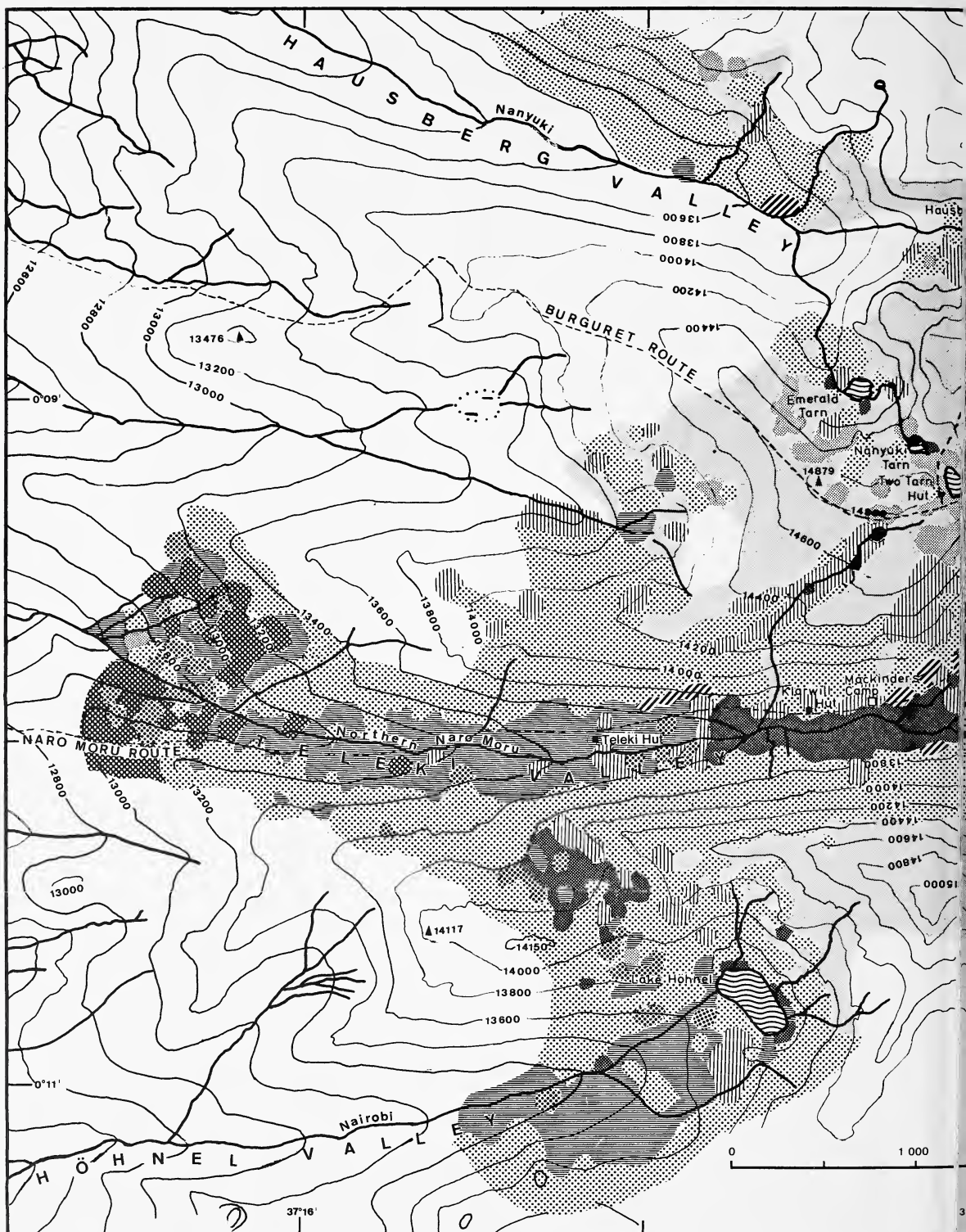
Type 1. 'Carex Bog'.

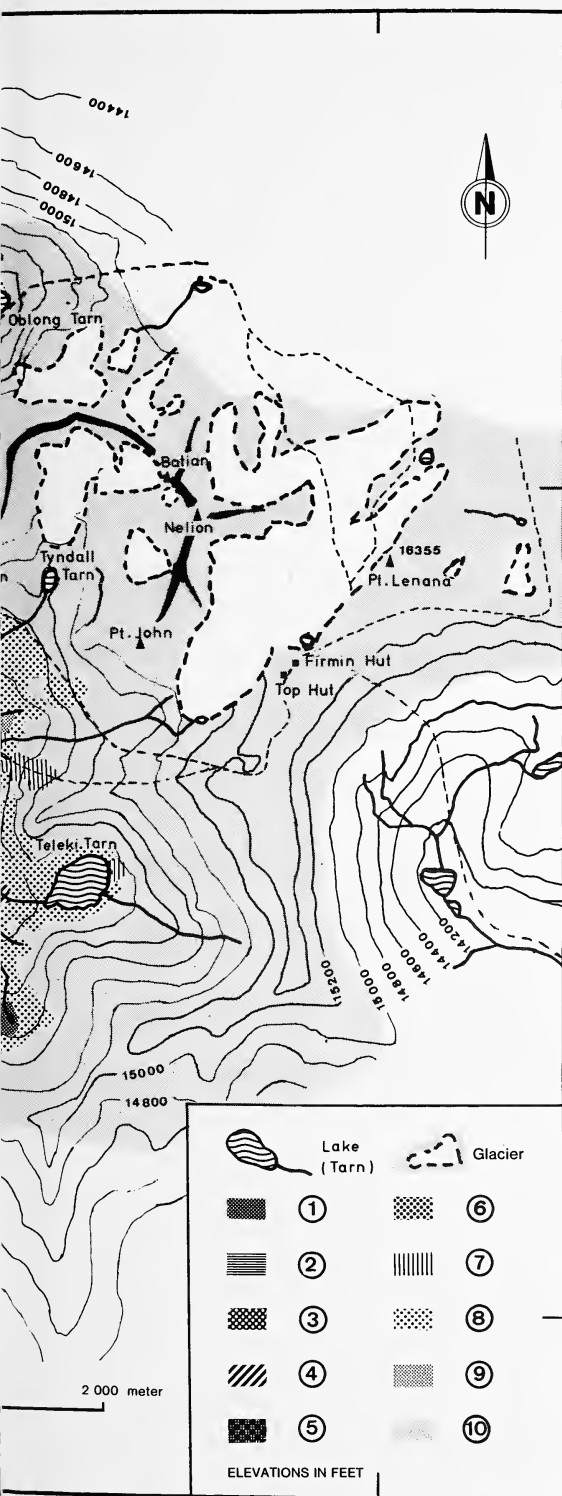
Teleki Valley. 5. 4. 79. Valley floor, 50 m west of Klarwill's Hut. Alt. 4170 m.—Square 10 × 10 m on flat and partially flooded ground. Plant cover 90%, water hollows 10%. Average height of vegetation 15 cm.

Type 2. 'Senecio brassica—Lobelia keniensis Community': **Plot A.** Teleki Valley. 5. 4. 79. 150 m N of Teleki Hut. Alt. 4120 m. Square 7 × 7 m on slightly sloping ground (5° towards SSW). Plant cover 95% including 15% mosses. Average height of vegetation 15 cm.

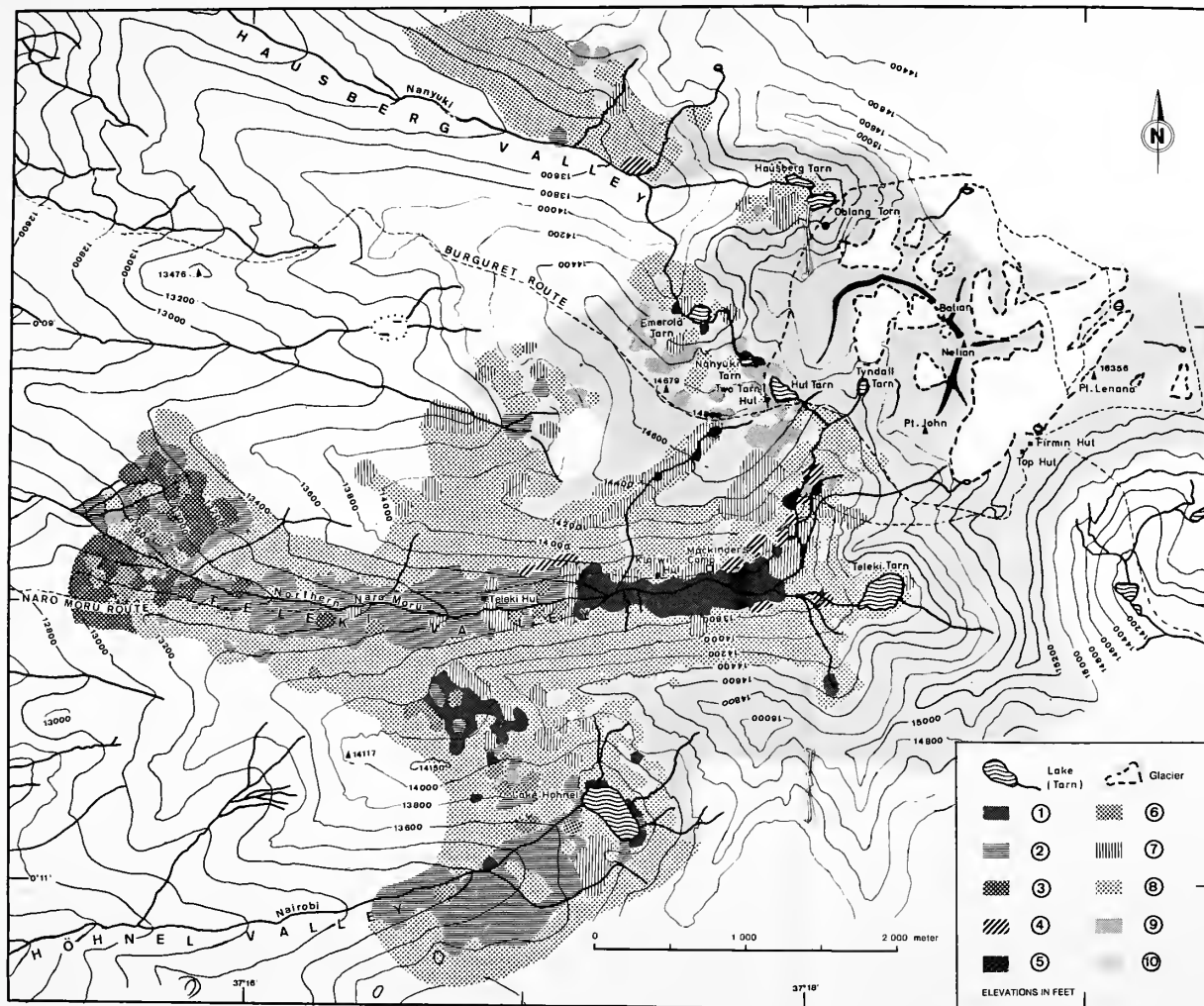
Plot B. Teleki Valley. 5. 4. 79. 15 m W of plot A. Square 7 × 7 m on slightly sloping ground (5° towards SSW). Plant cover 95% including 20% mosses. Average height of vegetation 20 cm.

Plot C. Teleki Valley. 2. 3. 79. Left slope of the valley, about 300 m E of Teleki Hut. Alt. 4130 m. Square 7 × 7 m on gently sloping ground (7° towards N). Plant cover 90% including 10% mosses; 10% water hollows. Average height of vegetation 15 cm.





- ① Tussock vegetation on wet soil (*Carex* bog)
- ② *Senecio brassica*/*Lobelia keniensis*-community (on wet soil)
- ③ *Senecio brassica*/*Lobelia keniensis*/*Erica*-community
- ④ Pure *Senecio brassica*-community
- ⑤ *Senecio keniodendron*/*Senecio brassica*-community (rare)
- ⑥ Mixed community of *Dendrosenecios* and Giant *Lobelias*
- ⑦ Tussock grassland on dry soil
- ⑧ *Dendrosenecio* woodlands
- ⑨ Open vegetation with *Lobelia telekii*
- ⑩ Bare soil with scattered vegetation



- ① Tussock vegetation on wet soil (Carex bog)
- ② Senecio brassica/Lobelia keniensis community (on wet soil)
- ③ Senecio brassica/Lobelia keniensis community
- ④ Pure Senecio brassica community
- ⑤ Senecio keniodendron/Senecio brassica community (rare)
- ⑥ Mixed community of Dendrosenecios and Giant Lobelias
- ⑦ Tussock grassland on dry soil
- ⑧ Dendrosenecio woodlands
- ⑨ Open vegetation with Lobelia telekii
- ⑩ Bare soil with scattered vegetation

Type 3. '*Senecio brassica*—*Lobelia keniensis*—*Erica arborea*—Community'. Teleki Valley. 7. 4. 79. About 2 km W of Teleki Hut, 10 m downwards of Naro Moru trail Alt. 3960 m. Square 5 × 5 m on considerably sloping ground (15° towards N to NNW). Plant cover 90%. Average height of vegetation 20 (—100) cm.

Type 4. 'Pure *Senecio brassica* Community'.

Teleki Valley. 5. 4. 79. 600 m ENE of Teleki Hut, 120 m N of Naro Moru trail. Alt. 4150 m. Square 5 × 5 m on gently sloping ground (7° towards S). Plant cover 80%; rocks and gravel 5% (a higher percentage was observed in the surroundings). Average height of vegetation 20 (—50) cm (without inflorescences of *Senecio brassica*).

Type 6. 'Mixed Community of *Dendrosenecios* and Giant *Lobelias*'

Teleki Valley. 7. 4. 79. About 2.1 km W of Teleki Hut, 10 m downwards of Naro Moru trail. Alt. 3960 m. Square 10 × 10 m on moderately sloping ground (15° towards N). Plant cover 90% including 10% pure moss cover; bare soil 10%.

Type 7. 'Tussock Grassland on Dry Soil'.

Plot A. Teleki Valley. 5. 4. 79. 150 m N of Teleki Hut. 20 m E of Type 2, Plot A. Alt. 4120 m. Square 7 × 7 m on slightly sloping ground (5° towards SSW). Plant cover 85% including soil covering mosses (25%). Average height of vegetation 8 cm.

Plot B. Teleki Valley. 7. 4. 79. Opposite to Klarwill's Hut. 20 m vertical distance from the valley bottom. Alt. 4190 m. Square 10 × 10 m on steeply sloping ground. (35° towards N). Plant cover 80% including 2% mosses; rocks and gravel 5%. Average height of vegetation 30 cm.

Plot C. Teleki Valley. 5. 4. 79. 300 m W of Klarwill's Hut. 10 m N of Naro Moru trail. Alt. 4165 m. Square 5 × 5 m on slightly sloping ground (3° towards S). Plant cover 80%, rocks and gravel 3%. Average height of vegetation 5-10 cm.

Plot D. Ridge between Teleki Valley and Hut Tarn. 6. 4. 79. Close to trail from Mackinders Camp to Two Tarn Hut. Alt. 4330 m. Square 10 × 10 m on moderately sloping ground (12° towards SSW). Plant cover 45%; rocks and gravel 45%. Average height of vegetation 12 cm.

Type 8. '*Dendrosenecio* Woodlands'.

Plot A. '*Senecio keniodendron*—*Festuca pilgeri* Community'. Teleki Valley. 2. 3. 79. Left slope of the valley, 300 m E of Teleki Hut. Alt. 4160 m. Square 7 × 7 m on stronger inclined ground (about 25° towards N). Plant cover 95%. Tree layer (*Senecio keniodendron*): 2 flowering unbranched trees, about 4 m high. Field layer containing 5 young rosettes of the same species: Average height 30 cm.

Plot B. '*Senecio keniodendron*—*Alchemilla argyrophylla* Community'. Teleki Valley. 2. 3. 79. Same situation as A, about 30 m W of plot A. Alt. 4160 m. Square 7 × 7 m Plant cover 90% including mosses (10%). Tree layer (*Senecio keniodendron*): 1 large, repeatedly branched and flowering individual, 1 dead stem). Field layer: Average height 25 cm.

Type 9. 'Open Vegetation with *Lobelia telekii*'.

Ridge between Teleki Valley and Hut Tarn. 6. 4. 79 Trail from Mackinders Camp to Two Tarn Hut. Alt. 4400 m. Square 10 × 10 m, slightly sloping ground (5° towards SSW). Plant cover 8%; rocks 55%, frost heaved soil 37%. Plant development predominantly close to rocks.

Type 10. 'Scattered Vegetation on Bare Soil'.

Ridge between Teleki Valley (Mackinders Camp) and Hut Tarn. Alt. 4480 m. No distinct square. Bare frost heaved soil with significant designs of solifluction. Plant cover less than 5%.

From these two main communities the following types were derived which differ with respect to importance and extension. Where the moorlands merge into the upper alpine zone, *E. arborea* forges ahead into the *S. brassica*-*L. keniensis* Community thus forming a special community with a rather restricted area. This vegetation type was called *S. brassica*-*L. keniensis*—*E. arborea* Community (type 3). Towards the upper boundary of the *S. brassica* areas, *L. keniensis* is left more and more behind resulting finally in a 'Pure *Senecio brassica* Community' on moist but not too wet soils (type 4). Probably, with respect to these variations of type 2, soil conditions are not as decisive as climatical influences.

Other wet soil areas exhibiting indications of occasional or permanent flooding show no or at most a few poorly developed specimens of *Dendrosenecios* or giant *Lobelias*. Forming lower tussocks than in the moorlands *Carex monostachya* often dominates these open 'turf communities'. Corresponding to one of Hedberg's main types this community was called "Carex Bog" (type 1).

Although the two main types of plant communities, i.e. the *S. brassica*—*L. keniensis* Community and the *Dendrosenecio* Woodlands are usually separated by a very sharp boundary, a few areas were found where *S. keniodendron* and *S. brassica* occur simultaneously. This was the case on terraced slopes where both *Dendrosenecios*, both giant *Lobelias* and sometimes also *E. arborea* were intermingled (Mixed Community of *S. keniodendron*, *S. brassica* and giant *Lobelias* = type 6). In one of these stands, the giant *Lobelias* were missing and therefore this vegetation type was recorded as '*S. keniodendron*-*S. brassica* community' (type 5).

Because of the complex mosaic structure of the tussock or dwarf scrub fieldlayer of the 'Dendrosenecio

Woodlands' a subdivision of this community (type 8) was omitted in the vegetation map. Similarly no difference was made between rather dense populations of the Giant Groundsel and more or less open areas with merely scattered individuals of this species. The latter merge into 'open communities' without big rosette species which may resemble the 'Carex Bog' but are characteristic for drier substrates. Consequently *C. monostachya* never appears to a considerable extent. Tussocks of *Festuca pilgeri* ssp. *pilgeri* are often dominating this areas, but also other life forms, especially dwarf scrubs or small rosette herbs may prevail. Although several communities might be included it was necessary for mapping purposes to establish one larger unit called 'Tussock Grassland on Dry Soil' (type 7), which by name corresponds to one of Hedberg types. Because of their poor expression in the upper alpine zone of Mt Kenya, two further types of Hedberg's classification, namely the 'Helichrysum Scrub' and the 'Alchemilla Scrub' are included in type 7. The typical open 'Tussock Grassland' may be favoured by occasional fires in contrast to the dwarf scrub communities which are damaged by this factor (Hedberg 1964). Thus the former may be regarded as 'replacement community' of the latter and perhaps of the 'Dendrosenecio Woodlands' in general.

In the surroundings of Teleki Valley *Senecio keniodendron* stands are extending to an altitude of about 4400 or 4500 m. At the higher elevations the dense stands disperse into scattered individuals growing on favourable sites of rocks or the margins of bare soil areas subjected to strong solifluction. Herbaceous vegetation is also confined to areas which are protected from solifluction by rocks. Thus a flowering cushion of *Senecio keniophytum* R. E. Fries was found in a crack on the summit of Nelion (5187 m).

Bare soil with scattered vegetation was established as type 10. In some places of high elevation an intermediate type between 7, 8 and 10 was found, which can be distinguished by a relative abundance of *Lobelia telekii*. It was described as 'Open Vegetation with *Lobelia telekii*' (type 9).

Vegetation types

For the following floristical notes compare table 1.

Type 1. Tussock vegetation on wet soil (Carex Bog). In most cases *Carex monostachya* is the prevailing member of this community, but generally also *Festuca pilgeri* is found. In case of doubt with respect to type 7 the presence of *Ranunculus oreophytus* which also appears in the *Senecio brassica* communities (types 2 and 6) is decisive for the "Carex Bog".

Type 2. *Senecio brassica*—*Lobelia keniensis* Community. The two characteristic species are accompanied by changing portions of *Festuca pilgeri* and *Alchemilla johnstonii*. The latter species seems to prefer moist soils in contrast to *Alchemilla argyrophylla* which suggests to be more robust and more often was found on drier ground.

But this latter dwarf scrub as well as *Helichrysum brownei* could also be detected on the moderately wet habitats of this community.

Types 3, 4, 5, 6 represent other communities with *Senecio brassica* on more or less wet soils. The same field layer species were found as in type 2. The densely crowded rosettes of *Haplocarpha rueppellii* often cover remarkable areas thus competing with moss cushions which appear to be squeezed between the *Haplocarpha* leaves. Some herbs such as *Swertia crassiuscula* and *Peucedanum friesiorum* are growing preferentially in the corresponding communities with *Erica arborea* (types 3 and 6).

Type 7. Tussock Grassland on dry soil. This unit was already mentioned to combine different communities. *Festuca pilgeri* ssp. *pilgeri* appears in high and low abundances as well. Nearly all other members of the *Senecio brassica* communities and the 'Dendrosenecio Woodlands' including a few and scattered individuals of reduced vitality of the four big rosette species themselves can be found. However, several small herbs, such as *Dianthoseris schimperi*, *Haplosciadium abyssinicum*, *Alchemilla argyrophylla*, white-lanate forms of *Senecio keniophytum* and various species of *Helichrysum*, *Pentastichis* and *Agrostis* allow to distinguish this unit from the "Carex Bog". The plant cover is lower in height as compared with the field layer of the Dendrosenecio Woodlands and often constricted to rather small areas. Bare spots become more frequent with increasing elevation.

Type 8. Dendrosenecio Woodlands. Analysis of this community revealed only a few species. This seems to be a particularity of the type. There are either monotonous field layers of *Festuca pilgeri* ssp. *pilgeri* or of *Alchemilla argyrophylla*. Only *Alchemilla johnstonii* was found combined with both of them. The 'woolly candles' of *Lobelia telekii* often are very conspicuous but they never obtain high numbers of cover abundance. The fact that the plant list given by Hedberg (1964) contains about 16 species of flowering plants might be due to the fact that types 2-6 were included in his Dendrosenecio Woodlands.

Type 9. Open vegetation with *Lobelia telekii*. This community is rather similar to type 7 with regard to

its floristical composition. So it may be subordinated to it, representing only a high altitudinal facies which can be distinguished by an increased frequency of *Lobelia*.

Type 10. Bare soil with scattered vegetation. Plant cover is less than 5% in this unit. This raises some problems in calling this unit a "community". Among the plant species that are able to grow under the hard conditions between the rocks or on gravel and other fine material moved by solifluction, different forms of *Senecio keniophytum* are prevailing. Other species are listed in table 1.

DISTRIBUTION OF THE UNITS

It is evident from the map that apart from the large areas exhibiting predominantly bare soil surfaces (type 10), the *Dendrosenecio* Woodlands' (type 8) cover most of the area comprised by the present investigation. Open 'Tussock Grassland' (type 7) generally appears to be included within this belt, but on the whole it is restricted to smaller plots. This is also true for type 9, which obviously replaces type 7 along the upper border of the *Dendrosenecio* Woodlands. Among the 'wet soil' communities (types 1-6) found along the valley bottom and along creeks or in flat hollows that of *Senecio brassica* with *Lobelia keniensis* (type 2) obviously covers the widest area. The closely related variant with *Erica arborea* (type 3) was found below 4050 m and in the Teleki Valley only. There it is the predominant community at an altitude up to 3950 m. On the other hand the "Carex Bog" (type 1) replaces type 2 at altitudes above 4150 m, especially in the rather flat and therefore occasionally flooded areas along the rivulets and around some of the tarns. The 'Pure *Senecio brassica* Community' (type 4) could be regarded as a phenomenon of desintegration of the *Senecio brassica*—*Lobelia keniensis* Community. It is restricted to isolated spots on the lower parts of the valley slopes and especially occurs in the upper part of Teleki Valley in between type 2 and 8 or 1 and 8. The 'Mixed Community of *Senecio keniodendron* and *Senecio brassica*' (type 5) covers only a small area below Tyndall Tarn at about 4300 m. The 'Mixed Community of *Senecio keniodendron*, *Senecio brassica* and giant *Lobelias*' (type 6) appears somewhat more frequently and especially in transitional areas between types 1-3 and 8.

In the vegetation map all the 'wet soil' types (1-6) including the 'mixed communities' were contrasted by darker hatchings whereas the 'dry soil' types (7-9) were marked by light signatures.

CONCLUDING REMARK

The authors are well aware that the results presented in this communication are rather a preliminary survey and have to be completed by further field work. Including also the alpine areas not covered at the present stage a deletion of types of minor importance or an addition of new types of plant communities may result. Aerial photographs if available one day would be very helpful and could lead to some corrections of the present map. So this study should be regarded as a first step of a comprehensive vegetation map of Mount Kenya National Park.

ACKNOWLEDGEMENTS

This vegetation analysis which was used as basement for further ecological investigations, was enabled by the funds for African studies of the University of Bayreuth and by the A. F. W. Schimper-Stipendium established by H. and E. Walter.

The authors are very grateful for the efficient support given by Assistant Director (Research), Mr S. Taiti, Ministry of Tourism and Wildlife, Wildlife Conservation and Management Department, Nairobi. We acknowledge the skilful assistance in fieldwork of our coworkers C. Cheseny and J. Mwangi. Finally we would like to thank Dr. Jürgen Bregel, Geographisches Institut University of Bayreuth, for his advice and for the production of the vegetation map.

REFERENCES

- BECK, E., REHDER, H., PONGRATZ, P., SCHEIBE, R., SENSER, M. (1981) Ecological Analysis of the Boundary between the Afroalpine Vegetation types "Dendrosenecio Woodlands" and "*Senecio brassica*—*Lobelia keniensis* Community" on Mt Kenya. Jl. E. Africa nat. Hist. Soc. natn. Mus. 172
- DU RIETZ, G. E.: Life-forms of Terrestrial Flowering Plants. I. Acta phytogeogr. suec. 3, 1-96 (1931).
- HEDBERG, O.: Features of Afroalpine Plant Ecology. Acta phytogeogr. suec. 49, 1-144 (1964)
- MUELLER-DOMBOIS, D., ELLENBERG, H.: Aims and Methods of Vegetation Ecology. New York—London—Sydney—Toronto: Wiley 1974.

Received 20 April 1980

EDITORS: JEAN HAYES, M.G. GILBERT, E. LUCAS

SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01313 7419